
2015 Cardiovascular Risks Standing Review Panel

Status Review for:

*The Risk of Cardiac Rhythm Problems and
The Risk of Orthostatic Intolerance During Re-Exposure to Gravity*

Comments to the Human Research Program, Chief Scientist

2015 Cardiovascular Risks Standing Review Panel (SRP) Status Review WebEx/teleconference
Participants:

SRP Members:

Jason Carter, Ph.D. – Michigan Technological University
David Krummen, M.D. – VA San Diego Medical Center/University of California, San Diego
Gail Thomas, Ph.D. – Pennsylvania State College of Medicine
Michael Ziegler, M.D. (chair) – University of California, San Diego Medical Center

NASA Johnson Space Center (JSC):

Yael Barr, M.D.
David Baumann
Rachel Brady
Kerry George
Stuart Lee, Ph.D.
Linda Loerch, Ph.D.
Brian Mayeaux, Ph.D.
Peter Norsk, M.D.
Zarana Patel, Ph.D.
Susan Steinberg, Ph.D.
Michael Stenger, Ph.D.
John Uri, Ph.D.
Jennifer Villarreal

NASA Headquarters (HQ):

Bruce Hather, Ph.D.

NASA Research and Education Support Services (NRESS):

Tiffin Ross-Shepard

On November 4, 2015, the Cardiovascular Risks SRP, participants from the JSC, HQ, and NRESS participated in a WebEx/teleconference. The purpose of the call (as stated in the Statement of Task) was to allow the SRP members to:

1. Receive an update from the HRP Chief Scientist (or designee) on the status of NASA's current and future exploration plans and the impact these will have on the HRP.
2. Receive an update on any changes within the HRP since the 2014 SRP meeting.
3. Receive an update by the Element or Project Scientist(s) since the 2014 SRP meeting.
4. Participate in a discussion with the HRP Chief Scientist (or designee) and the Element regarding possible topics to be addressed at the next SRP meeting.

Based on the presentations and the discussion during the WebEx/teleconference, the SRP would like to relay the following information to Dr. Shelhamer, the HRP Chief Scientist.

General Comments:

1. Overall, the SRP thinks the quality of the WebEx/teleconference was excellent. The three presentations were easy to hear, and the online presentation system worked well. It was organized well, with minimal delay between talks.
2. All three presenters (Dr. Hather, Dr. Norsk, and Dr. Stenger) did a fine job fitting a tremendous amount of data within a two-hour timeframe and the work being done is laudable.
3. Dr. Stenger's presentation was presented in a clear, logical order and highlighted recent progress in the research portfolio. The SRP found it helpful that papers were referenced in the presentation slides, and also found it beneficial having the presentations sent early, since much more has happened in the past year than can be compressed into a two hour presentation.
4. For future meetings, the SRP would like more specific references to papers with high quality new data to provide a background for the SRP prior to the meeting.

Specific Comments Regarding the Orthostatic Intolerance (OI) Risk:

1. With regards to OI Risk for a Mars mission, the suitability of the current countermeasures depends largely upon the mission requirements for the astronauts (and upon requirements for astronaut performance in an emergency). Therefore, the researchers need to have the best projection as to what is planned for the team upon touchdown. For instance, if the plan for the astronauts is to rest and recover for 24-48 hours, then compression garments and acclimatization may be suitable. However, if they may be asked to exit the vehicle (such as in an emergency), then perhaps additional countermeasures (EVA suit design, etc.) will be needed. If such procedures and protocols have not been developed, then the SRP thinks these should at least be outlined to the best of NASA's ability at this time, so that the researchers can get a head start on developing countermeasures for these contingencies.

2. To adequately assess the OI risk mitigation, it will be helpful in the future to present the continuous blood pressure data (in addition to heart rate data on landing day) as it pertains to the Functional Field tests and the promising mitigation of OI risk with compression garments. Some of the concerns expressed regarding the Portapres data can likely be mitigated with analyses that focus on acute changes from a reliable baseline reference.
3. Impaired vision in the VIIP studies was appropriately presented adjacent to the OI presentation. Obviously, centrifugal countermeasures to avoid visual impairment will also ameliorate OI. The SRP would like it noted that almost any treatment to diminish vascular or cerebrospinal fluid pressure on the eye will also affect OI. It is possible that diuretics during microgravity might improve OI if fluid is repleted prior to return to gravity.

Specific Comments Regarding the Cardiac Rhythm (Arrhythmia) Risk:

1. The SRP requires more specific information regarding best estimates, given current and projected technology, regarding the amount of time in transit to Mars, on Mars, and on return from Mars. We also need more information regarding the radiation environment during these three phases of the Mars mission (e.g., Curiosity Rover data). Finally, the SRP needs data regarding estimated spacecraft attenuation of radiation during the three phases of the Mars mission to estimate the risk of radiation induced cardiovascular disease. This could be provided in a briefing from the Space Radiation Program Element and the Space Human Factors Engineering project at a future SRP meeting.
2. There is concern that the radiation outside of low Earth orbit might impair vascular endothelial function. Endothelial damage might be diminished by antioxidants, but there is concern from vitamin E studies that antioxidants might increase cancer risks. However, low levels of radiation are unlikely to cause serious damage to the endothelium. Some have suggested that a 3% cancer risk increase from radiation would not be acceptable. Knowledge of the level of radiation that will be tolerated might determine whether radiation induced endothelial damage is a problem that should be addressed.
3. Dr. Stenger mentioned interesting research being performed on both risk estimation for astronauts (PI: Levine) and vascular injury basic science (PI: Natarajan). The SRP would benefit from an update on this work to help with our evaluation process during future SRP meetings.